PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

Toppenish-Simcoe Instream Flow Restoration And Assessment

BPA project number: 9705300
Contract renewal date (mm/yyyy): ☐ **Multiple actions?**

Business name of agency, institution or organization requesting funding
Yakama Indian Nation

Business acronym (if appropriate) YIN

Proposal contact person or principal investigator:

Name	Lynn Hatcher
Mailing Address	P.O. Box 151
City, ST Zip	Toppenish, WA 98948
Phone	(509) 865-6262
Fax	(509) 865-6293
Email address	lynn@yakama.com

NPPC Program Measure Number(s) which this project addresses
7.1B, 7.6A-D, 7.7, 7.8G, 7.8H

FWS/NMFS Biological Opinion Number(s) which this project addresses
Not Applicable

Other planning document references
Wy-Kan-Ush-Mi Wa-Kish-Wit (CRITFC 1995); Yakima River Subbasin Salmon and Steelhead Production Plan (YIN 1990); WA State Salmon and Steelhead Stock Inventory

Short description
Identify extent of anadromous populations, identify land status, characterize habitat and discharge; model irrigation use; restore instream flows by land lease or purchase and/or water substitution; modify irrigation diversions to mimic natural runoff

Target species
Steelhead (Mid-Columbia ESU)

Section 2. Sorting and evaluation

Subbasin
Lower Mid-Columbia; Yakima River, Toppenish Creek, Simcoe Creek

Evaluation Process Sort

CBFWA caucus	Special evaluation process	ISRP project type

Mark one or more caucus	If your project fits either of these processes, mark one or both	Mark one or more categories
☒ Anadromous fish ☐ Resident fish ☐ Wildlife	☒ Multi-year (milestone-based evaluation) ☒ Watershed project evaluation	☐ Watershed councils/model watersheds ☐ Information dissemination ☐ Operation & maintenance ☐ New construction ☒ Research & monitoring ☒ Implementation & management ☒ Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description
20501	Yakima Subbasin Habitat/Watershed Project Umbrella
9603501	Satus Watershed Restoration
9803300	Restore Upper Toppenish Creek Watershed
9705300	Toppenish-Simcoe Instream Flow Restoration and Assessment
9206200	Yakama Nation Riparian/Wetlands Restoration
9705100	Yakima Basin Side Channels
9705000	Little Naches Riparian and In-Channel Restoration
9803400	Reestablish Safe Access Into Tributaries of the Yakima Subbasin
9901300	Ahtanum Creek Watershed Assessment
20117	Yakima River Subbasin Assessment (new)

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship
	Bureau of Rec.-Yakima River Basin Water Enhancement Project (P.L. 96-162)	Focused primarily on improving irrigation efficiency downstream (Wapato Irrigation Project) of 9705300. Provides habitat enhancement in adjacent reach of Toppenish Creek.

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?
1998	Characterized magnitude, timing and extent of project watercourse (streams and man-made structures) discharge before, during and after one complete irrigation season. Discharge measurement data continue to be collected.	Defined the extent and magnitude of stream, canal, ditch and drain flows within Project boundaries, and were able to observe and document the number and age structure of salmonids stranded by diversions which desiccated natal stream reaches.
1998	Completed first year of comprehensive steelhead spawner surveys in project area streams	By enumerating steelhead redds in Project area streams, we will be able to see changes in the numbers of returning adults from year to year.

1998	Identified extent of habitat utilization by steelehead parr and juveniles in project watercourses, both natural and man-made.	Steelhead parr and juveniles were found in virtually every site sampled within the Project, which gave us insight into areas previously thought unutilized by the species. This finding has shown us areas where future investigation is vital.
1998	Rescued and relocated approximately 1,000 juvenile steelhead from stream reaches weeks from total desiccation to perennial reaches above diversion points.	This accomplishment steps directly toward the primary goal of the Project--to increase the population of steelhead in the Toppenish basin.

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Characterize Project area water budget	a	Update and adaptively develop Project Management Plan
1	Note: most tasks under this objective will produce data which will be updated to Project GIS	b	Map delivery and drainage systems, lands, update GIS
1		c	Incorporate orthophotos, district maps and other coverages into GIS
1		d	Add cropping patterns from crop reports
1		e	Ground-truth GIS data
1		f	Measure watercourse (streams drains, ditches, laterals) discharge and temperature over time and distance
1		g	Assess and model consumptive use and irrigation efficiency
1		h	Analyze Project and historic discharge data to determine magnitude and timing of alternative diversion strategies
2	Survey creek channel, floodplain and alluvial aquifer	a	Assess channel morphology and condition
2		b	Use current and historic aerial photos to track channel width, sinuosity and riparian vegetation trends over time
2		c	Monitor Toppenish Creek alluvial aquifer
3	Monitor steelhead and other biota in Project watercourses	a	Spring steelhead spawner surveys and population censuses (electrofishing, snorkeling)
3		b	Install, maintain and monitor a 5-foot screwtrap (purchased w/ FY98 funds) to index the size, age structure, number and timing of outmigrant Toppenish basin steelhead.
3		c	Qualitatively monitor hyporheic macroinvertebrates in conjunction with Obj. 2, Task c.
4	Implement Project Management Plan	a	Approach Yakama Tribal Council for management support and help in disseminating Project scope and objectives
4		b	Restore instream flow by system modifications, water substitution, and land

			purchase or lease (initial target ~160 acres in FY00; expansion in FY2001 and beyond)
4		c	Identify willing participants within project that will decrease or cease late spring-summer diversions
5	Maintain leases, monitor steelhead and riparian ecosystem response	a	Maintain leases and enforce compliance to ensure instream flows during irrigation season.
5		b	Monitor numbers of returning steelhead adults by yearly spawning ground surveys and adult counts at Prosser and Roza monitoring windows. Outmigrant trends observed at screwtrap will help to judge effects of increased instream flows.

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	8/1997	9/1999		Completion of Project GIS	25.00%
2	8/1997	9/1999			25.00%
3	9/1997	9/2009	Number of steelhead redds and juveniles		25.00%
4	10/1999	10/2009		Completion of Project Management Plan, First tracts of land secured either through purchase or lease (FY00)	20.00%
5	10/1999	10/2009	Number of adults at Prosser, number of redds and juveniles, recovery of riparian vegetation in previously dewatered reaches	Largest number of steelhead redds on record, Toppenish Creek perennial in all reaches, all available lands bought or leased.	5.00%
				Total	100.00%

Schedule constraints
High runoff exacerbating spawner surveys, inability to secure leases/buy lands due to current lease (which may extend past projected completion date) or unwilling landowners, GIS info which may need to be gathered rather than integrated from other sources

Completion date
Assuming leases are secured in FY99 w/ FY98 funds, yearly lease payment will be needed unless Project lands are purchased, which will require increased initial funding but will terminate financial needs much sooner.

Section 5. Budget

FY99 project budget (BPA obligated): $0

FY2000 budget by line item

Item	Note	% of total	FY2000
Personnel	.5 FTE Fish Bio (lead), 1 FTE GIS Specialist, 1 FTE Tech II, .25 FTE Bookkeeper, .25 Office Assist	%40	$93,281
Fringe benefits	25.3% of Personnel Salaries	%10	$23,600
Supplies, materials, non-expendable property	Miscellaneous field supplies, office equipment, GIS Desktop computer	%3	$8,000
Operations & maintenance	Vehicle insurance, rental and mileage; Utilities, Office space rental, Repairs and Maintenance	%5	$11,050
Capital acquisitions or improvements (e.g. land, buildings, major equip.)	Land Purchase--80 acres @ $650/acre	%22	$52,000
NEPA costs		%0	0
Construction-related support		%0	0
PIT tags	# of tags: 0	%0	0
Travel	Includes Tech training, travel per diem	%1	$2,000
Indirect costs	23.5% calculated on all items in this budget except Capital acquisitions	%15	$34,247
Subcontractor	Irrigation Consultant	%2	$5,000
Other	Land rental--80 acres @ $35/acre	%1	$2,800
	TOTAL BPA FY2000 BUDGET REQUEST		$231,978

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
Wapato Irrigation Project-Yakima River Basin Water Enhancement Project (P.L. 96-162)	Utilization of Irrigation Consultants working on Conservation Plan-capitalize on infrastructure and products (GIS) in place to aid 9705300 efforts thus eliminating start-up costs. Concepts and preliminary plans have been discussed, FY98.	%0	0
		%0	
		%0	
		%0	
		Total project cost (including BPA portion)	$231,978

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	$200,000	$125,000	$125,000	$80,000

Section 6. References

Watershed?	Reference

☐	Columbia River Inter-Tribal Fish Commission (CRITFC). 1995. Wy-Kan-Ush-Mi Wa-Kish-Wit (Spirit of the Salmon): the Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs, and Yakama Tribes, Volume I. CRITFC, Portland, OR.
☐	CRITFC. 1995. Wy-Kan-Ush-Mi Wa-Kish-Wit (Spirit of the Salmon): the Columbia River anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs, and Yakama Tribes, Volume II-Subbasin Plans. CRITFC, Portland, OR.
☐	Yakama Indian Nation. 1990. Yakima River Subbasin Salmon and Steelhead Production Plan. Columbia Basin System Planning, Portland OR.
☐	Washington Department of Fisheries, Washington Department of Wildlife, and Western Washington Treaty Indian Tribes. 1993. 1992 Washington State salmon and steelhead stock inventory (SASSI). Wash. Dep. Fish Wildl., Olympia, 212 pp.
☐	Gregg, D.O., and L.B. Laird. 1975. A general outline of the water resources of the Toppenish Creek basin, Yakima Indian Reservation, Washington. Open-File report 75-19, U.S. Geological Survey, Tacoma, Washington.
☐	Busack, C, C. Knudsen, A. Marshall, S. Phelps, and D. Seiler. 1991.Yakima Hatchery Experimental Design. Progress Report, DOE/BP-00102. Bonneville Power Administration, Portland, OR.
☐	Busby, P.J., T.C. Wainwright, G.J. Bryant, L.J. Lierheimer, R.S. Waples, F.W. Waknitz and I.V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Oregon and California. NOAA Technical Memorandum NMFS-NWFSC-27, Seattle, WA.
☐	Ward, J.V., and J.A. Stanford. 1996. Ecological connectivity in alluvial river ecosystems and its disruption by flow regulation. Regulated Rivers 11:105-119.
☐	Stanford, J.A., and J.V. Ward. 1993. An ecosystem perspective of alluvial rivers: connectivity and the hyporheic corridor. Journal of the North American Benthological Society 12:48-60.

PART II - NARRATIVE

Section 7. Abstract

The Toppenish Creek basin comprises only 10% of the Yakima River subbasin, but contributes 20% of the Yakima's summer steelhead run (Mid-Columbia ESU, proposed for ESA listing). The Toppenish Simcoe-Unit (Unit) of the Wapato Irrigation Project (WIP) diverts streamflow from Toppenish Creek and its tributaries to irrigate roughly 2,000 acres. In doing so, these diversions can desiccate long reaches of streams, killing juvenile steelhead. Land status identification, water use quantification and the extent of steelhead utilization within the Unit must be accomplished to determine parcels of land with water that can be leased or purchased to return diverted streamflow into natal streams to maintain aquatic species assemblages. In addition, a comprehensive accounting of the Unit will allow us to identify possible sources for water substitution, leaving flows instream for aquatic species.

The main objectives and approach of this Project are to monitor all steelhead life stages as to location and timing of habitat utilization, quantify and locate all sources of diversion and augmentation, model consumptive use, and identify land status to develop an adaptive Management Plan and decision support system to actively pursue lands available for acquisition to return irrigation water for instream use. If land acquisition is not possible, we hope to work with landowners to restrict diversion timing to periods when surface discharge is not limiting (spring runoff). We expect that providing perennial flow to all stream reaches in the Project area will have a positive affect on steelhead populations, measured by yearly spawner surveys and fisheries censuses.

By FY2000, we will have completed two seasons of field data collection, the Project GIS, and the Project Management Plan. Integrating Project products and those of other activities in the basin, we will have a decision support system in place to begin implementing the Management Plan. In doing so, we will be able to intelligently secure tracts of land and water to return to Toppenish basin streams for instream use. In addition, we hope to reduce irrigation system inefficiencies and limit summertime diversions while avoiding hardship on local landowners. Future activities will hinge on adaptive management as we develop

our knowledge base. We hope to utilize this knowledge base in other YIN BPA-funded activities, both on and off the Yakama Indian Reservation.

This project serves to further the goals of the FWP, especially by conserving genetic diversity (7.1B), meeting habitat goals, policies and objectives (7.6A-D), protecting habitat and conserving water (7.8H) with the cooperation of private land owners (7.7), and providing instream flows for steelhead (7.8G).

Section 8. Project description

a. Technical and/or scientific background

Project Setting and Background

Toppenish Creek and its tributaries, wholly contained within the boundaries of the Yakama Indian Reservation, comprise a 625 square-mile catchment that contributes about 96,000 acre feet/year to the Yakima River system (Figure 1). Watershed ecotones respond to a 5,000 foot elevation gradient and vary from Cascade Range forests to Columbia Plateau shrubgrass steppe. Within the lower watershed, intensive irrigated agriculture produces a variety of economically prominent crops.

Streamflows in the Toppenish basin are fed primarily by snowmelt and therefore exhibit a hydrograph that peaks in mid-spring and reaches baseflow in late summer. The possibility for short duration, high-intensity runoff exists when snowpack is present, especially in the form of rain-on-snow, and rain-on-melting snow events. These events can produce flooding, the extent of which is exacerbated by human activities such as diking, cross-floodplain roads, and stream channelization. Floodplain developments have impaired creek-floodplain interactions. The Toppenish Creek alluvial fan, affected primarily by diking and roads, no longer serves to distribute floods and sediment across the floodplain. Creekflow is crowded into a simplified channel and aquifer recharge occurs only during large events, in a largely uncontrolled fashion.

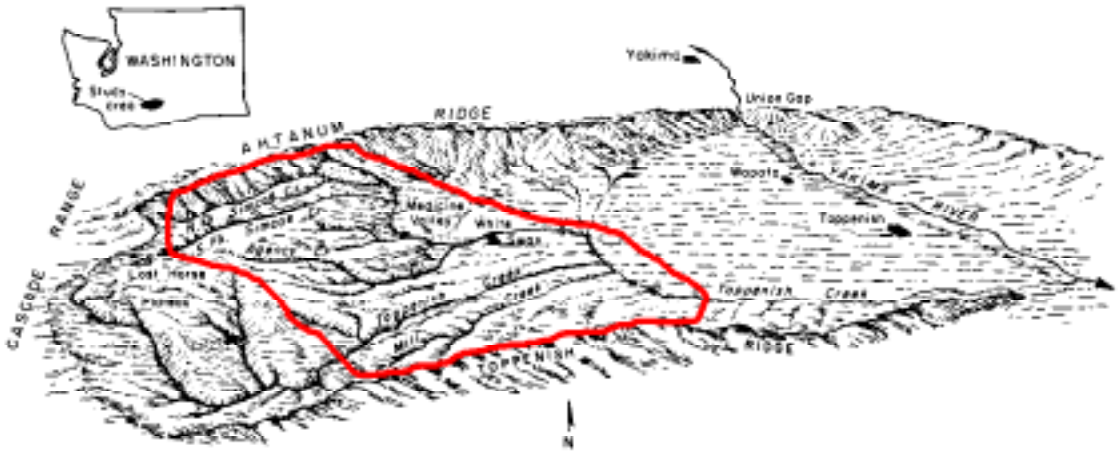

Figure 1. Toppenish-Simcoe Project area and vicinity (inside heavy line) map (reproduced from Gregg and Laird, 1975).

The nature and extent of irrigated agriculture has had a profound effect on the fishery resources of the Toppenish basin. The Toppenish-Simcoe Unit of the Wapato Irrigation Project is capable of delivery to approximately 2,000 acres by outdated diversion structures, some of which lack any form of screening. When water is diverted in late spring and throughout the summer, long reaches of Toppenish and Simcoe Creeks become dry, especially in a water-short year (Figure 2).

Figure 2. Typical Toppenish Creek summer steelhead habitat below diversions, August 1998.

Conversely, stream reaches below irrigation returns receive hot, turbid discharge out of phase with the natural hydrograph which further serves to degrade rearing habitat and promote adverse water quality conditions for both anadromous and resident aquatic species. In addition to the detrimental habitat effects of fluctuating discharge, the network of irrigation ditches and drains (along with stream entrenchment) has altered the natural runoff regime by helping to eliminate shallow aquifer recharge by spring overbank flooding. This loss of recharge to the groundwater component of the ecosystem has eliminated a mechanism that served to attenuate annual stream temperatures, providing a source of cool water to late-summer baseflows and warm refugia during the winter. Aquatic species assemblages have suffered accordingly. In addition, cultural uses of the area have been impacted by impaired groundwater/surface water interactions. Tribal elders talk of numerous springs once prevalent in the Project, where none are observed today.

Fishery Resources

These conditions are obviously detrimental to aquatic species assemblages in streams that produce about one-fifth of all wild summer steelhead in the entire Yakima River basin. Fish tissue analyses indicate that Toppenish/Simcoe steelhead are genetically dissimilar from other Yakima basin stocks, as well as neighboring Satus Creek fish (Busack *et.al.*, 1991; Busby *et al.*, 1996). Despite extremely degraded rearing habitat, Toppenish and Simcoe summer steelhead continue to persist.

Toppenish Creek and Satus Creek steelhead have suffered serious declines in numbers since reservation population monitoring began in 1988. Nearly all of the remaining reservation production is in Satus Creek, but natural factors account for little or none of the difference between the two watersheds. Arguably, irrigation has contributed greatly to the precipitous decline of Toppenish/Simcoe steelhead. In fact, Toppenish Creek was estimated to have produced more steelhead than Satus Creek as recently as the 1950's. Local problems mirror the coast-wide decline in steelhead populations that have occurred in recent years. The Middle Columbia River ESU, including Yakima River subbasin summer steelhead, is a candidate species for listing under the Endangered Species Act. A final listing determination is due in March 1999. Yakama Reservation steelhead are important drought-adapted stocks whose interaction with

hatchery fish has been kept to a minimum. These populations should therefore be protected with maximum effort.

Proposed Solution

Our hypothesis is that restoration of a "natural" discharge regime will recharge the entire stream ecosystem and support those food-webs basic to the survival of all life stages of steelhead (Ward and Stanford, 1992; Stanford and Ward, 1993). This hypothesis is inherent to reaches dewatered annually by diversions, but is also applicable to those reaches which experience extreme discharge fluctuations as a function of irrigation practices (withdrawals and additions to and from the natural channel). In addition to providing conditions conducive to the regrowth of native vegetation, this project would provide in place mitigation for steelhead. This project would protect prime spawning and rearing habitat, and could restore juvenile steelhead to previously underutilized reaches of project streams affected by unsatisfactory water quantity and quality.

An important underpinning of this project is the concept that instream flows, necessary to sustain aquatic species assemblages, are also vital to the maintenance of entire riparian ecosystems. Our plans to monitor the aquifer associated with of a 5-mile dewatered reach of Toppenish Creek will provide valuable insight into the flux of surface water and its associated shallow groundwater. This information could be vital to understanding placement and timing of groundwater substitution for irrigation supply, given a properly functioning annual cycle of recharge.

Approximately 70% of the 2,000 acres under the Toppenish-Simcoe Unit are held in tribal trust status while fee patent owners control the remainder. The majority of lands in the affected area are under the control of the Yakama Nation, so there exists an excellent opportunity for substitution or purchase of idle lands. If the acreage involved was higher and the percent of affected land in tribal trust lower, this project would be much more difficult to accomplish. In addition, acreage under this demand system has declined during the 1985-1995 drought season. Although the reasons for this decline are not fully known, we hope to capitalize on the opportunities to acquire land and water.

This project is part of an effort throughout the watershed to define the socioeconomic, cultural and natural uses of lands and water. Two seasons of valuable work will have been completed with FY98 funds, and a sizeable database is in development. The data gathered and experience gained by Project personnel is already paying dividends and will provide the decision base for future project tasks. The main consequence of an additional year or years of non-funding for this project will leave unfinished the beginnings of a productive effort to secure favorable streamflows for the survival of a genetically distinct population of Mid-Columbia ESU summer steelhead.

b. Rationale and significance to Regional Programs

The Yakama Nation's current watershed projects were first developed using information resulting from 20 years of fisheries evaluations in the Yakima Subbasin. Our experience led to primary authorship of the Yakima Subbasin Plan and leadership of the YKFP. The long-term goal of the Yakama Indian Nation is to restore salmon and steelhead to harvestable levels, while maintaining the genetic integrity and adaptability of populations. We see this as inseparable from the systemwide goal of the FWP: *a healthy Columbia River basin* that "*supports both human settlement and the long-term sustainability of native fish and wildlife species in native habitats where possible, while recognizing that where impacts have irrevocably changed the ecosystem, we must protect and enhance the ecosystem that remains*" (2.1).

This Project, its methodologies, tasks and ultimate goals, responds either directly or indirectly to the following FWP measures:

- *Measure 7.1B Conserve Genetic Diversity* By returning perennial flow to dewatered reaches of Toppenish and Simcoe Creeks, we can utilize miles of rearing habitat and augment the number of steelhead in the basin without hatchery supplementation. Mitigation would occur in place. Analyses

have shown Toppenish basin steelhead to be genetically dissimilar from other Yakima subbasin stocks, so genetic conservation of these fish should be a high priority.

- *Measure 7.6A Habitat Goal, 7.6B Habitat Policies, 7.6C Coordinated Habitat Planning, and 7.6D Habitat Objectives* Habitat protection and improvement are proximal goals of this project aimed at achieving the ultimate goal of increasing the number of Toppenish basin steelhead. In order to complete the tasks and obtain the objectives of the Project, we will need to coordinate planning between private landowners, other Tribal Programs, and state and federal entities on the Reservation. This Project is aimed specifically at securing tracts of land and water for return to instream purposes, both directly and indirectly meeting Habitat Objectives. Other efforts in the basin aim to remedy certain physical habitat problems and our Project hopes to find ways to provide instream flows without imposing harm to landowners.

- *Measure 7.7 Cooperative Habitat Protection and Improvement with Private Landowners* After we have collected and analyzed all sociological, physical and biological data (delivery and drainage system discharge, fisheries surveys, land status and ownership, cropping patterns, etc.), we will be able to complete a Project Management Plan that prioritizes lands and water for acquisition. Private landowners will then be contacted accordingly to attain Project objectives. If purchase is not an option, we hope to convince landowners to tailor diversions so that a more natural runoff regime is seen in Project streams. In doing so, we hope that shallow alluvial aquifers will recharge, providing baseflows for the riparian ecosystem and all associated cultural, biological, and irrigation interests. Landowner cooperation will be easier to achieve if we have a thorough, competent, and complete understanding of the system on which to base our desired management changes.

- *Measure 7.8G Instream Flows for Salmon and Steelhead and 7.8H Water Conservation* These two measures, especially as related to this Project, warrant combined discussion. We propose to find innovative ways to leave water instream to help maintain aquatic species and ecosystems, especially steelhead. Through identifying water conservation and substitution opportunities, we hope to provide late spring and summer instream flows. However, we are also applying the hypothesis that overbank flows and the preservation of a "natural" runoff regime are important as "ecosystem" instream flows. In order to accomplish the task of distributing spring freshets across alluvial floodplain reaches, we will approach landowners to change diversion timing, and rely on other activities in the basin to affect structural changes in floodplains that inhibit vertical and lateral connectivity.

c. Relationships to other projects

The Yakima Subbasin Habitat/Watershed Project Umbrella discusses the general, conceptual relationships of projects in the Yakima Subbasin. This Umbrella also discusses the interdependence of these projects with the Yakima/Klickitat Fisheries Project. More specifically, this project is related through various FWP measures in the following BPA projects:

9803300 Restore Upper Toppenish Creek Watershed Addresses watershed issues that affect streamflow into area covered under this proposal. Will augment Project decision support system.

9901300 Ahtanum Creek Watershed Assessment Knowledge and experience base of project covered under this proposal will improve management and data collection efforts of 9901300. Both projects share similar goals and objectives.

9603501 Satus Watershed Restoration Project covered under this proposal has benefitted from equipment and resource sharing.

9206200 Yakama Nation Riparian/Wetlands Restoration This project has developed a land acquisition and management system that will benefit the project covered under this proposal.

In addition to the BPA funded projects described above, this proposed project is directly related to the following US Bureau of Reclamation activity:

Yakima River Water Enhancement Project Water conservation planning and Toppenish Creek Corridor Enhancement sections of this project will improve irrigation efficiency and fish habitat in reaches of Toppenish Creek downstream of project covered under proposal.

Finally, this proposed project would benefit from activities funded through:

Yakama Nation Emergency Flood Damage and Abatement Project for Wapato Irrigation Project Facilities This project is improving floodplain management on Toppenish Creek that will have corollary fisheries benefits to certain areas covered under this proposal.

d. Project history (for ongoing projects)

We began collecting field data in March, 1998, after receiving FY98 funds and hiring appropriate personnel. Our first task was to survey all stream reaches assumed open and accessible to spawning steelhead. Due to spawn timing in the Toppenish basin, high discharge and poor water clarity can impede a "complete" redd count. Although we didn't find as many redds in the basin (caveats omitted) as previous years ('89, '90, '97), the number of different streams utilized was twice that of the past.

Concurrent with the onset of spawning surveys, 24 discharge transects were installed in Project streams, delivery and drainage channels. Data have been collected at each discharge site at least weekly since launching the Project. We are beginning to get a good idea of the Unit's water budget, and have begun updating a previously developed irrigation model. In addition to discharge data, water temperature is monitored at 25 sites throughout the Project to determine the relationship, if any, between discharge and temperature over space and time.

As diversions began and stream discharge decreased, we began electrofishing and snorkeling many thousands of feet of Project watercourses with surprising results. Virtually every stream reach, canal, ditch and drain sampled produced parr and juvenile steelhead. We now have a baseline data set that defines the population and age-structure of steelhead and other fish in watercourses throughout the Project. These data will be invaluable to determining the proximal and ultimate success of the Project—increasing the number of Toppenish basin steelhead.

Historic surface water records have been statistically analyzed to gain insight into stream discharge duration and frequency. These data will be vital to the development of a time-series model that accounts for natural streamflow variation, diversion and streamflow contribution to groundwater.

Discharge gaging sites, redd locations, Project watercourses, crop coverages, fish population census data, temperature data collection locations have been incorporated into the Project GIS. The GIS is currently integrating layers collected through other funding sources on the Reservation. Ground-truthing of data has begun, and GPS equipment is used as needed to fill in gaps and improve the quality of the GIS.

The Yakama Nation Fisheries Program, before the onset of this Project, has never had a crew solely dedicated to working on fisheries issues in the Toppenish basin. As a function of this, we were able to track and record the fate of water in a reach of Toppenish Creek dewatered primarily by diversion. We had the manpower and equipment to rescue numerous juvenile and parr steelhead trapped in rapidly drying residual pools and transport them to perennial reaches of Toppenish Creek. In pools that apparently received recharge by shallow alluvial groundwater flow, we were able to observe (by snorkeling) juvenile steelhead behavior and measure microhabitat temperatures with external temperature probes. We hope these data, when evaluated, will give insight into the thermal-moderation effects of groundwater recharge at baseflow periods and their relation to fish, especially steelhead.

In an attempt to determine the direction and magnitude of shallow alluvial groundwater flow, we tried installing piezometers in the dewatered alluvial fan reach of Toppenish Creek. A tractor-mounted

post-pounder on loan from the Satus Restoration Project (BPA #9603501) was used to attempt to push drive-points into alluvial cobbles and gravels. This technique proved problematic for a number of reasons. A hollow-core auger from the Boise Regional office of the Bureau of Reclamation, loaned with a crew and experienced geologist at no cost, found it no easier to penetrate the alluvium to the required depth. We are working on getting this equipment back on-site in FY99 to try different bits and techniques which will hopefully allow us to install piezometers and four eight-inch diameter wells to qualitatively monitor hyporheic macroinvertebrates as another performance indicator relative to returning discharge to adjacent Toppenish creek.

We plan to complete another season of field work, contract irrigation consultants, purchase a 5-foot screw trap and provide funding for all other aspects of the Project through FY99 with FY98 funds. Although the project was not funded for FY99, we have judiciously stretched monies awarded for one FY into two.

Finally, further development of progress history can be gotten by reading FY98 Quarterly reports submitted to BPA COTR Joe DeHerrera.

e. Proposal objectives

1. Characterize Project area water budget
   - *Product*: GIS of Project land status, delivery and drainage systems, watercourse discharge, irrigation consumptive use model, draft Management Plan
2. Survey creek channel, floodplain and alluvial aquifer
3. Monitor steelhead and other biota in Project watercourses
   - *Product*: Database of steelhead spawning locations and redd numbers; outmigrant age structure, number and timing; qualitative data of hyporheic macroinvertebrates
4. Implement Project Management Plan
   - *Product*: Project Management Plan; purchased and/or leased lands and water used for instream purposes, directly under the auspices of the Yakama Indian Nation and available for cultural uses
5. Maintain leases, monitor steelhead and riparian ecosystem response

f. Methods

1. *Characterize Project area water budget.* Update conceptual Management Plan with data collected and analyses performed to adapt future activities. Continue development of GIS to include land status, delivery and drainage systems and basin streamcourses. Incorporate orthophotos, district maps and other coverages into Project GIS. Use irrigation district crop reports, data compiled from current surface water adjudication and recent aerial photographs to add cropping patterns to GIS. Measure surface water diversions, return flows and temperature in Project watercourses over time and distance with sufficient resolution to account for accretion and seepage gains/losses. Incorporate and analyze all available gaging station data and collected Project data to develop a descriptive model of watercourse flow by season and location, thus producing an accurate and dynamic estimate of Project water budget. Assess consumptive use and irrigation efficiency by utilizing withdrawal, return and cropping pattern data. Develop decision support system, update and begin draft Management Plan that outlines priority lands and water for acquisition.

2. *Survey creek channel, floodplain and alluvial aquifer.* Assess channel morphology and condition by cursory survey with auto-level (in entrenched reaches) and Proper Functioning Condition method developed by the Bureau of Land Management. Use current and historic aerial photos to track channel width, sinuosity and riparian vegetation trends over time. Monitor dewatered Toppenish Creek alluvial aquifer by installing a network of piezometers and measuring groundwater levels weekly over time to gain an idea of the magnitude and direction of groundwater flow relative to Toppenish Creek over time. In addition to piezometers, we hope to install eight-inch diameter wells for macroinvertebrate samples (see Objective 3, below).

3. *Monitor steelhead and other biota in Project watercourses.* Conduct yearly spring spawner surveys and population censuses (electrofishing, snorkeling). Install, maintain and monitor a 5-foot screwtrap located downstream of all rearing reaches to index the size, age structure, number and timing of outmigrant Toppenish basin steelhead. This activity serves as the baseline from which we will judge Project success based on the working hypothesis that securing year-round favorable discharge in Project streams will increase the total number of adults returning to the system to spawn each year. Qualitatively monitor hyporheic macroinvertebrates in wells by weekly pumping and cursory identification and enumeration. It is our hypothesis that perennial flow in the dewatered reach will foster a functioning, 3-dimensional ecosystem (Ward and Stanford, 1992; Stanford and Ward, 1993) and increase the stream's ability to rear steelhead.

4. *Implement Project Management Plan.* Finalize Project Management Plan by assessing the efficacy and reality of output of objectives 1-3, above. Approach Yakama Tribal Council for approval of Plan, and help in disseminating its scope and objectives to enrolled tribal members and private landowners within the Project boundary. Identify obstacles to Plan's success to Tribal Council and ask for approval of measures to ensure that water replaced instream for aquatic and riparian ecosystems will remain instream with no further consumptive use. Actively pursue the acquisition of lands, as decided by Plan, by purchase and/or lease. Identify opportunities for instream flow by water substitution and/or system modifications (conversion to drip, etc.). Identify willing participants within project that will delay diversion timing to allow aquifer recharge, or decrease or cease late spring-summer diversions to restore instream flows.

5. *Maintain leases, monitor steelhead and riparian ecosystem response.* Finances will be required to maintain leases on a yearly basis. Enforcement by way of "policing" the stream and backing from Tribal Council will be needed to ensure that any water returned to streams is not appropriated for consumptive use at some point downstream of the point of addition. Steelhead population monitoring will be accomplished by observations at the Prosser and Roza video windows and yearly Toppenish Basin spawner surveys to determine the number of adults returning to the basin. Indices of outmigration age structure, number, and timing will be derived from monitoring a 5-foot screwtrap downstream of rearing reaches in the Project to evaluate the effects of returning flows to instream uses.

The proximal and ultimate success of this project will be measured by redd surveys in the Toppenish basin. These spring steelhead spawner surveys can be problematic to due to inclement weather and, especially, high discharge that impairs visual acuity. If runoff is high and prolonged in any given year, we oftentimes have limited ability to perform a "complete" count. To counter this problem, we will continue late-spring and summer population censuses (by snorkeling and electrofishing) to monitor the number of steelhead parr and juveniles. Comparison of these counts with the database of counts will enable us to see population trends. In addition to population censuses, we will have a screwtrap in place to index the number of outmigrants, thus helping to evaluate population trends. Counting windows at the Roza and Prosser diversion dams will help index the number of fish returning to the Yakima subbasin.

In order to increase the number of steelhead in the Toppenish basin, it is our premise that increased late-spring and summer instream flows are required. To accomplish this, we need to change diversion timing, increase irrigation efficiency and purchase or lease irrigated lands and lease or substitute water. This sequence of events will, of course, require funding, but will also require the cooperation of Tribal and private entities. Uncooperative entities will hinder the success of this project.

Another critical assumption of this project is that water returned to dewatered reaches will remain in-channel. We have, in FY98 & FY99, defined a natural stream loss in some reaches. A working hypothesis is that returning perennial flow will recharge the aquifer and allow surface flow to remain in-stream.

g. Facilities and equipment

After receipt of FY98 funds, a GIS desktop and field notebook computer were purchased. Certain stream surveying and discharge measuring (Marsh-McBirney vel meter) equipment were borrowed from other projects. During FY99, on FY98 funds, a 5-foot screwtrap will be purchased.

FY2000 funding will support the rental of 1 4WD pickup and its associated costs (insurance, mileage, maintenance, office space rental and utilities, and miscellaneous field gear and office supplies. In addition, we hope to purchase a better GIS machine to handle our rapidly-evolving Project GIS. We will use equipment and resources from other projects, when possible, to minimize cost.

h. Budget

Personnel

Includes 1.5 FTE professional staff, 1.0 FTE field technicians, 0.25 FTE bookkeeper and 0.25 FTE office assistant. The professional staff directs field data acquisition, statistically analyzes hydrologic and biological data, develops GIS maps, reports on project findings and develops the management plan. Technicians are responsible for most field data gathering including discharge measurement, stream and fish surveys, and initial data entry. The bookkeeper and office assistant handle purchasing paperwork, budget tracking and projections, and financial reporting.

Fringe Benefits

This standard item is 25.3% of the personnel item.

Supplies, Materials etc.

Includes a computer (PC) to speed GIS analysis by ending reliance on shared equipment. It also includes miscellaneous field and office supplies.

Operations and Maintenance

Includes rental, mileage charges and insurance for one GSA vehicle for field work, repairs and maintenance on project equipment and rental of office space and utilities.

Capital Acquisitions etc.

Based on purchase of 80 acres of land at $650/acre (one of the water-conservation options expected in the management plan), but could include capital improvements to conserve or substitute irrigation water.

Travel

Includes per diem and related fees for travel to project-related conferences or training.

Indirect Costs

This standard item is 23.5% of all budget items except capital acquisitions.

Subcontractor

Includes services provided to the project by irrigation engineers to analyze irrigation system performance and conservation options.

Other

Based on rental of 80 acres of land at $35/acre (one of the water-conservation options expected in the management plan).

Section 9. Key personnel

Kale Gullett, Fishery Biologist I, ½ FTE Email: gullett@yakama.com

Education

M.S. Rangeland Ecology and Watershed Management/Water Resource Management (Hydrology Emphasis), May 1996, University of Wyoming, College of Agriculture
B.S. Zoology and Physiology/Fisheries Biology, May 1994, University of Wyoming, College of Arts and Sciences

Employer

Yakama Nation Fisheries Resource Management Program

Current Responsibilities

Research, management and restoration of stream ecology and fisheries resources of the Toppenish Creek basin, Yakama Indian Reservation; in-house Instream Flow Incremental Methodology (IFIM) technical experience base for recommendation and evaluation of Reservation instream flows; YIN SOAC alternate; *Acquavella* Task Force; member of Toppenish Creek Corridor Enhancement Plan writing and technical team; evaluation of hydraulic effects of proposed riverine modifications; field, computer and technical assistance for other Program employees.

Employment History

Miller Ecological Consultants, Inc., Fort Collins, Colorado.
Research Technician, August 26, 1996 to December 1, 1996. Assisted in Colorado River Squawfish (endangered) radio telemetry project to determine late-summer microhabitat preferences for instream/passage flow determination.

USDA-US Forest Service Rocky Mountain Region Fish Habitat Relationships Unit, Laramie, Wyoming.
Research Associate I, May 11, 1996 to August 1, 1996. Field and lab application of IFIM for completion of instream fishery flow recommendation reports to Regional Forester, Denver, CO.

University of Wyoming Department of Rangeland Ecology and Watershed Management and Wyoming Water Resources Center, Laramie, Wyoming.
Graduate Research Assistant, September, 1994 to May, 1996. Evaluation of the relationship of fish habitat hydraulics to a region-wide habitat capability criterion.

USDA-US Forest Service Rocky Mountain Forest and Range Experiment Station, Laramie, Wyoming.
Research Fisheries Technician, Summer 1992 and 1993. Collection of fisheries, habitat and hydrology data for Colorado River Cutthroat (sensitive) trout migration project.

Expertise

Education and applied experience mainly in the field of instream flow application and research, evaluation of riverine fishery hydraulics and habitat, hydraulic modeling, stream ecology and hydrology, watershed management and fisheries biology and management.

Publications

Gullett, K.A., T.A. Wesche, R.N. Schmal and W.A. Hubert. 1998. Comparison of salmonid habitat availability to streamflow characteristics in the central Rocky Mountains: Some insights for water resource decision-makers. *Regulated Rivers: Research & Management*, in preparation.

Gullett, K.A., T.A. Wesche and R.N. Schmal. 1998. Evaluation of the USFS Rocky Mountain Region 2 40% standard habitat capability criterion. USFS National Fish Habitat Relationships Unit *Currents*, GPO, Washington, D.C., in progress.

Wesche, T.A. and K. A. Gullett. 1996. Bypass (instream) fishery flow recommendations for Cow Creek below Overland Ditch Diversion, Colorado. Completion report to Rocky Mountain Regional Forester, Denver CO, to fulfill Interagency Agreement #1102-0001-94-041 between the USDA-US Forest Service and University of Wyoming Cooperative Extension Service.

Section 10. Information/technology transfer

The technical information resulting from this project (and its component tasks) will be distributed in the following ways:

- A completion (annual) report will be submitted to Bonneville at the close of the fiscal (calendar) year and Bonneville will distribute copies to all individuals and agencies on its mailing list. Although this Project was not funded for FY99, we will continue to submit reports.
- Progress and methodologies will be appropriately formatted and submitted to the Northwest Aquatic Information Network (StreamNet) and made available to the public via the Internet.
- In addition to StreamNet, Project results will be made available on YKFP web-site, as soon as development is complete.
- Project results will also be presented and critiqued in a series of workshops hosted by project personnel to further educate the public as to the benefits of informed management and multi-disciplinary cooperation.

Results will be used to continue implementation of the project, measure success, and serve as a feedback loop for future adaptive management.

Congratulations!